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Original Article

Health Indicators Associated with Active Commuting Among Adult Workers: A Cross-Sectional Study.

Dima Leonel Lemus Araya[1], Carlos Arquimides Lagos Olivos[2], Angelo Adasme Ossandon[2], Iransé Oliveira-Silva [1]*

[1] Graduate Program in Human Movement and Rehabilitation, Evangelical University of Goiás, Anápolis, Brazil
[2] Graduate curse of Physical Education, University of Tarapacá, Arica, Chile
* Correspondence: iranse.silva@unievangelica.edu.br; 0000-0003-2692-1548

Abstract

Background: Physical inactivity among adults is a major public health concern and is associated with increased risk of obesity, cardiometabolic diseases, poor sleep quality, and reduced well-being. Active commuting, particularly walking and cycling, has been recognized as an effective strategy to incorporate physical activity into daily routines while promoting sustainable urban mobility. However, evidence regarding its association with health indicators among Brazilian workers remains limited, particularly in medium-sized cities. **Objective:** To investigate the association between active commuting to work and indicators of physical activity, body composition, sleep quality, and subjective well-being among adult workers. **Methods:** This cross-sectional observational study included 22 male workers from a company in Anápolis, Goiás, Brazil. Participants were classified according to their usual commuting mode into an Active Commuting Group (ACG; n = 10), composed of workers who regularly walked or cycled to work, and a Passive Commuting Group (PCG; n = 12), composed of workers who used motorized transportation. Physical activity level was assessed using the long version of the International Physical Activity Questionnaire (IPAQ). Body composition was evaluated by bioelectrical impedance analysis, sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and subjective well-being through self-reported measures of daily energy, perceived stress, work disposition, and general well-being. Descriptive statistics were expressed as mean ± standard deviation, and between-group comparisons were performed adopting a significance level of $p < 0.05$. **Results:** The groups were similar regarding age, length of employment, weekly workload, and commuting distance ($p > 0.05$). Compared with the PCG, the ACG demonstrated significantly higher walking time (214 ± 88 vs. 72 ± 55 min/week; $p < 0.01$), moderate physical activity (196 ± 101 vs. 83 ± 64 min/week; $p = 0.02$), and total physical activity (3098 ± 1244 vs. 1285 ± 654 MET-min/week; $p < 0.01$). Workers in the ACG also showed lower body mass index (24.5 ± 2.8 vs. 27.6 ± 3.4 kg/m²; $p = 0.02$) and body fat percentage (21.7 ± 5.3 vs. 28.9 ± 6.2%; $p < 0.01$). Sleep quality was significantly better in the ACG, with lower global PSQI scores (5.8 ± 1.9 vs. 9.6 ± 2.4; $p < 0.01$). In addition, active commuters reported greater daily energy (7.8 ± 1.2 vs. 5.6 ± 1.7; $p < 0.01$), lower perceived stress (4.8 ± 1.6 vs. 6.9 ± 1.9; $p = 0.02$), greater work disposition (8.0 ± 1.1 vs. 6.1 ± 1.5; $p < 0.01$), and higher overall well-being (8.2 ± 1.0 vs. 6.0 ± 1.6; $p < 0.001$). **Conclusion:** Active commuting to work was associated with higher physical activity levels, healthier body composition, better sleep quality, and greater subjective well-being among adult workers. These findings reinforce the potential of active commuting as an accessible strategy for promoting health and support public policies aimed at encouraging walking and cycling in urban environments.

Keywords: Active commuting; Adults; Physical activity; Body composition; Subjective well-being; Sustainable mobility.

1. Introduction

Active mobility refers to any form of non-motorized transportation that requires some degree of physical effort (1). Among the various forms of active mobility, the most common are walking and cycling, both of which are closely associated with individual factors (such as age, sex, income, and education), environmental factors (including climate, topography, and the built environment), and trip-specific characteristics, such as travel distance, purpose of the trip, and travel cost (2).

Active mobility has regained much of the importance it once held and is now recognized as a key strategy for improving transportation quality while reducing economic, social, environmental, and health-related impacts (3).

In the United States, for example, bicycle use has increased substantially over the past two decades, with cycling becoming an important symbol of urban revitalization. Cities such as San Francisco and Portland have been at the forefront of this movement (4).

In Europe, concerns regarding greenhouse gas emissions from motorized vehicles have become a priority on the European Union agenda, leading to policies that encourage cycling and public transportation as strategies to mitigate environmental impacts (5).

Across Latin America, significant changes have taken place in public transportation systems, alongside the implementation of numerous initiatives aimed at promoting non-motorized modes of transportation, particularly walking and cycling (6).

In Brazil, the prevalence of active mobility varies according to several determinants, including age, sex, income, education, environmental conditions, travel distance, and transportation costs (2).

According to the Brazilian Ministry of Transport, walking and cycling account for the majority of trips in small urban centers (municipalities with fewer than 50,000 inhabitants), which represent more than 90% of all Brazilian municipalities. This predominance is largely attributed to the limited availability of public transportation in these areas and the restricted access to private automobiles due to the country's income inequality (5).

A nationwide study on active commuting in Brazil found that approximately one-third of employed men and women commute to work either by walking or cycling. Among both sexes, the prevalence of active commuting decreases with increasing income and educational attainment and is higher among younger adults, rural residents, and individuals living in the Northeast region. Depending on the metropolitan area, active commuting among lower-income individuals is two to five times more prevalent than among higher-income populations (2).

Because urban environments may hinder healthy lifestyle habits, including regular physical activity, public health and urban planning policies have sought to provide guidance and implement practical measures capable of promoting significant health benefits for urban populations (7).

Research has demonstrated that cities implementing sustainable mobility policies experience greater urban dynamism, enhanced public spaces, improved environmental quality, and stronger socioeconomic development. As observed in several developed countries, non-motorized transportation plays a vital role within the context of sustainable and smart cities (8).

In Brazil, the most recent sector-specific urban policy enacted was the National Urban Mobility Policy. Federal Law No. 12,587/2012 established the guidelines for the National Urban Mobility Policy (Política Nacional de Mobilidade Urbana—PNMU), whose primary objectives include increasing the share of public and non-motorized transportation within the national transportation matrix. The policy emphasizes the integration of urban planning, transportation, and traffic management while adhering to the principles of social inclusion and environmental sustainability.

Several mechanisms have been established to enable municipalities to implement the principles, guidelines, and objectives defined by the law. Among the most important are strategies to reduce dependence on private automobiles while encouraging the use of active transportation and public transit. Alongside demand-management measures for private vehicle use, it is essential to expand the availability of high-quality, safe, accessible, and affordable transportation services and infrastructure. Examples include well-designed and properly signposted cycling networks, accessible sidewalks, and comfortable, reliable, accessible, and low-cost public transportation systems.

Despite the progress achieved through the National Urban Mobility Policy (PNMU), Brazil still requires more effective and long-lasting measures to improve public transportation and to strengthen structural conditions that support active transportation (9).

The expansion of private motorized transportation has profoundly transformed urban environments, reducing opportunities for daily physical activity and contributing to increasing levels of sedentary behavior among adults. This trend is closely associated with the growing prevalence of non-communicable chronic diseases, including obesity, hypertension, type 2 diabetes mellitus, and cardiovascular disorders, which currently represent some of the leading causes of morbidity and mortality worldwide (10).

Against this backdrop, active commuting—particularly walking and cycling as habitual modes of transportation—has gained increasing recognition as an effective and sustainable strategy for promoting healthy lifestyles. Recent studies have shown that individuals who regularly use active modes of transportation demonstrate higher levels of physical fitness, lower risks of metabolic diseases, and greater life expectancy than those who primarily travel by motorized vehicles (11).

In middle-income countries such as Brazil, and in rapidly growing cities such as Anápolis (Goiás State), infrastructure for pedestrians and cyclists remains insufficient, limiting equitable access to active modes of transportation (12). Nevertheless, local studies have shown that adults who regularly engage in active commuting in this city present more favorable cardiovascular and metabolic health indicators, highlighting the potential of active transportation to improve public health (1).

Despite this evidence, there remains a lack of systematically synthesized scientific knowledge comparing the effects of active and motorized transportation on the physical health of adults. Furthermore, generating evidence within intermediate-sized cities such as Anápolis is essential for designing interventions tailored to local realities, thereby strengthening the scientific foundation supporting investments in active transportation infrastructure, road safety education, and healthy lifestyle promotion, in accordance with the United Nations Sustainable Development Goals (SDGs) 3 and 11 (13).

In this context, adopting alternative forms of active transportation, such as regular cycling or walking for daily commuting, represents a sustainable strategy capable of improving physical and metabolic health indicators among adults. Recent research has demonstrated that cycling as a means of transportation is associated with lower body fat levels, greater cardiorespiratory fitness, improved mental health, and a healthier cardiovascular profile (14).

Despite these well-established benefits, the use of active transportation remains limited in medium-sized cities such as Anápolis (Goiás, Brazil). Factors including inadequate infrastructure, urban designs that do not prioritize pedestrians and cyclists, and perceptions of traffic-related insecurity discourage their routine use. Consequently, workers who commute by bicycle or on foot constitute an important population for understanding how these habits influence overall health, particularly regarding cardiovascular, metabolic, and functional outcomes.

At present, few applied studies have examined this relationship within Brazilian occupational settings, especially in inland regions such as Anápolis. The scarcity of locally generated evidence limits the development of effective public health policies and initiatives promoting active mobility. Therefore, it is necessary to generate empirical evidence that enables comparisons between the health profiles of workers who commute by bicycle or on foot and those who rely on motorized transportation, thereby contributing to a comprehensive approach to occupational health and sustainable urban mobility.

The objective of this study was to evaluate the impact of active mobility on the health and well-being of adults.

Specifically, this study aimed to compare health and well-being indicators between individuals who regularly use active transportation and those who do not.

2. Methods

2.1 Study Design

This was a cross-sectional observational study with no manipulation of the independent variables.

The study was approved by the Research Ethics Committee of UniEVANGÉLICA and was conducted with authorization from the management of the participating company.

2.2 Population

The study population consisted of economically active adult men and women working in the city of Anápolis, Goiás, Brazil, who commuted daily between their homes and workplaces.

To date, there is no quantitative estimate in the literature regarding the size of this population.

2.3 Sample

The sample consisted of 22 adult male workers who voluntarily agreed to participate in the study. Only men were recruited because no female employee in the participating company regularly commuted using active transportation.

To publicize the study and encourage participation, information was disseminated through departmental announcements, meetings with sector representatives, e-mail invitations, and informational lectures.

2.4 Inclusion Criteria

Participants were eligible if they:

Were adults;

Worked in Anápolis;

Agreed to participate in all assessments;

Were not engaged in regular structured physical exercise;

For the Active Commuting Group, regularly commuted between home and work by walking and/or cycling during the study period.

2.5 Exclusion Criteria

Participants were excluded if they:

Failed to complete the evaluation protocols.

2.6 Procedures

After obtaining authorization from a company located in Anápolis, the study was publicized among employees, and workers from the maintenance and service departments were invited to participate. All volunteers who agreed to participate signed a written informed consent form.

Initially, participants underwent assessments of physical activity level, sleep quality, body composition, and energy expenditure.

Participants were subsequently categorized according to their usual commuting mode between home and work into two groups: the Active Commuting Group (ACG) and the Passive Commuting Group (PCG).

The ACG consisted of workers who had routinely commuted to work by walking or cycling during the previous three months. The PCG consisted of workers who had routinely commuted by car or motorcycle during the same period.

2.7 Measurement Of Study Variables

2.7.1 Physical Activity

Physical activity level was assessed using the long version of the International Physical Activity Questionnaire (IPAQ). The IPAQ estimates the weekly time spent performing physical activities.

The long version comprises 27 questions assessing physical activities performed during a typical week at vigorous, moderate, and light intensities, with a minimum duration of 10 continuous minutes. Activities are distributed across four domains (work, transportation, household activities, and leisure) and also include time spent sitting during the week. In addition, the questionnaire provides detailed information regarding physical activity accumulated through active commuting, which plays an important role in estimating overall physical activity levels (27,28).

Physical activity scores were calculated according to the Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) and expressed as MET-minutes/week.

Scores were calculated separately for each domain and also as an overall measure of physical activity. Participants accumulating at least 150 minutes per week of moderate- and/or vigorous-intensity physical activity were classified as physically active (29).

The IPAQ was selected because it has demonstrated validity and reliability comparable to other physical activity instruments and has been validated in 12 countries and 14 research centers. Furthermore, both its short and long versions allow assessment of large population samples, making it particularly suitable for international comparisons.

2.7.2 Sleep Quality

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a self-administered instrument designed to evaluate sleep quality and sleep disturbances over the previous month. The PSQI has been validated for use in the Brazilian adult population (30,31).

Only self-rated items contribute to the overall score. The seven component scores are summed to generate a global score ranging from 0 to 21, where a score of 0 indicates no sleep difficulty and a score of 21 indicates severe sleep problems across all domains.

2.7.3 Body Composition

Body composition was assessed using bioelectrical impedance analysis (BIA).

BIA is a non-invasive, rapid, practical, and painless method based on the passage of a low-intensity electrical current through the body. The impedance (Z), or resistance to current flow, is measured by the analyzer.

The most commonly used configuration is the tetrapolar model, in which four electrodes are placed on the hand, wrist, foot, and ankle. A low-intensity electrical current is applied through the distal electrodes, while the voltage drop resulting from body impedance is detected by the proximal electrodes.

2.7.4 Subjective Well-Being

Subjective well-being was assessed using the Subjective Well-Being Scale (Escala de Bem-Estar Subjetivo—EBES), developed by Albuquerque and Tróccoli (32). The instrument consists of 62 items distributed across three dimensions: positive affect, negative affect, and life satisfaction.

The EBES demonstrates adequate psychometric properties. Regarding construct validity, the three factors explained 44.1% of the total construct variance. Internal consistency was high, with Cronbach's alpha coefficients of 0.95 for positive affect, 0.95 for negative affect, and 0.90 for life satisfaction.

Responses are provided using a Likert-type scale ranging from "not at all" to "extremely."

2.8 Statistical Analysis

Statistical analyses were performed using SPSS software (version 27.0; IBM Corp., Armonk, NY, USA). Descriptive data are presented as mean ± standard deviation (SD).

Data normality was assessed using the Shapiro-Wilk test with Lilliefors correction. When normality assumptions were not met, logarithmic transformation of the variables was performed.

Ninety percent confidence intervals (90% CI) for the correlation coefficients were also calculated.

Statistical inferences regarding the correlation coefficients were made using a minimum meaningful correlation of 0.10. Statistical significance was established at $p < 0.05$.

3. Results

The sample consisted of 22 workers, including 12 participants in the Passive Commuting Group (PCG) and 10 participants in the Active Commuting Group (ACG). The mean age was similar between groups ($p > 0.05$). No significant differences were observed regarding years of employment or weekly working hours.

Table 1. Participant characteristics

Variable	PCG (n = 12)	ACG (n = 10)	p
Age (years)	36.4 ± 7.2	35.1 ± 6.8	0.63
Years of employment	6.1 ± 3.9	5.8 ± 3.4	0.79
Weekly working hours (h)	42.0 ± 3.1	41.6 ± 3.5	0.74
Home-to-work distance (km)	7.4 ± 3.6	5.2 ± 2.8	0.11

Participants in the ACG reported commuting to work primarily by bicycle (60%) and walking (40%), whereas those in the PCG used automobiles (67%) or motorcycles (33%).
Physical activity levels showed marked differences between the groups.

Table 2. Physical activity level (IPAQ)

Variable	PCG	ACG	p
Walking (min/week)	72 ± 55	214 ± 88	<0.01
Moderate activity (min/week)	83 ± 64	196 ± 101	0.02
Vigorous activity (min/week)	41 ± 52	72 ± 69	0.18
Total physical activity (MET-min/week)	1285 ± 654	3098 ± 1244	<0.01

Within the PCG, 42% of participants were classified as Irregularly Active B, 50% as Irregularly Active A, and only 8% as Very Active. In contrast, 40% of participants in the ACG were classified as Active and 60% as Very Active. Workers who used active commuting accumulated approximately 2.4 times greater weekly energy expenditure than those who used passive commuting.

The Pittsburgh Sleep Quality Index (PSQI) revealed significant differences between the groups across several domains. Overall, 83% of workers who commuted by car or motorcycle presented poor sleep quality, whereas this proportion was 30% among those who walked or cycled to work.

Table 3. Sleep quality (PSQI)

Domain	PCG	ACG	p
Subjective sleep quality	1.6 ± 0.7	0.9 ± 0.5	0.02
Sleep latency	1.8 ± 0.8	1.1 ± 0.6	0.03
Sleep duration	1.4 ± 0.7	0.9 ± 0.6	0.08
Sleep efficiency	1.5 ± 0.6	0.8 ± 0.5	0.01
Sleep disturbances	1.2 ± 0.5	0.9 ± 0.4	0.15
Use of sleep medication	0.6 ± 0.7	0.2 ± 0.4	0.09
Daytime dysfunction	1.5 ± 0.6	0.8 ± 0.5	0.01
Global PSQI score	9.6 ± 2.4	5.8 ± 1.9	<0.01

These findings indicate that adopting an active commuting lifestyle was associated with a 4.9-fold improvement in sleep quality.

Body composition was assessed using bioelectrical impedance analysis.

Table 4. Body composition

Variable	PCG	ACG	p
Body mass (kg)	83.4 ± 12.6	76.9 ± 10.2	0.15
Body mass index (kg/m²)	27.6 ± 3.4	24.5 ± 2.8	0.02
Body fat (%)	28.9 ± 6.2	21.7 ± 5.3	<0.01

Regarding adiposity classification, 58% of participants in the PCG were classified as overweight or obese, compared with 30% of those in the ACG.

Subjective well-being was assessed using a self-reported perception scale.

Table 5. Well-being indicators

Variable	PCG	ACG	p
Daily energy (0–10)	5.6 ± 1.7	7.8 ± 1.2	<0.01
Perceived stress	6.9 ± 1.9	4.8 ± 1.6	0.02
Work disposition	6.1 ± 1.5	8.0 ± 1.1	<0.01
Overall well-being	6.0 ± 1.6	8.2 ± 1.0	<0.001

4. Discussion

The findings of the present study indicate that workers who used active commuting modes (walking or cycling) for their home-to-work journeys exhibited significantly higher levels of physical activity, better body composition, superior sleep quality, and greater perceived well-being than workers who commuted by passive modes (car or motorcycle). These findings are consistent with recent international evidence identifying active commuting as an important behavioral determinant of health.

In the present study, workers in the Active Commuting Group accumulated significantly greater weekly physical activity (MET-min/week) than those in the Passive Commuting Group. This finding corroborates epidemiological evidence suggesting that active commuting represents an important source of physical activity in everyday life.

A study based on data from the UK Biobank, including more than 260,000 participants, demonstrated that individuals who cycled or walked to work accumulated significantly higher levels of total physical activity than those using motorized transportation (1).

Similarly, a systematic review conducted by Saunders et al. demonstrated that active commuting contributes substantially to total weekly physical activity and is associated with reductions in cardiometabolic risk factors (2).

Furthermore, evidence suggests that individuals who adopt active commuting accumulate more time engaged in moderate-to-vigorous physical activity throughout the day, reinforcing the role of active commuting as a form of incidental physical activity integrated into daily routines (3).

In the present study, workers who commuted by bicycle or on foot also exhibited lower body mass index (BMI), lower body fat percentage, and smaller waist circumference than those who commuted by car or motorcycle.

These findings are consistent with population-based studies demonstrating an association between active commuting and more favorable body composition indicators. Flint et al. reported that individuals who actively commute have significantly lower BMI than those using motorized transportation (4).

Likewise, a meta-analysis demonstrated that active commuting is associated with lower adiposity and a more favorable cardiometabolic profile, even after adjustment for sociodemographic and lifestyle factors (15).

These findings suggest that active commuting may increase daily energy expenditure, thereby contributing to improved energy balance and, consequently, more favorable body composition outcomes.

Although the present study did not directly assess cardiovascular biomarkers, the observed improvements in physical activity and body composition are consistent with evidence linking active commuting to better cardiovascular health outcomes.

A meta-analysis demonstrated that individuals who actively commute have a significantly lower risk of developing cardiovascular disease than users of motorized transportation (8).

Similarly, prospective studies have shown that active commuting is associated with reduced risks of both all-cause mortality and cardiovascular mortality, reinforcing its role as an effective health promotion strategy (1).

Another important finding of the present study was the superior sleep quality observed among workers who used active commuting modes, as evidenced by significantly lower Pittsburgh Sleep Quality Index (PSQI) scores.

The literature consistently indicates that higher levels of physical activity are associated with significant improvements in sleep quality. A meta-analysis demonstrated that physically active individuals exhibit greater sleep efficiency, shorter sleep latency, and reduced daytime sleepiness (33).

Moreover, regular physical activity may contribute to circadian rhythm regulation and increase homeostatic sleep pressure, both of which facilitate the consolidation of nocturnal sleep.

Therefore, it is plausible that the greater volume of physical activity accumulated by participants in the Active Commuting Group contributed to the superior sleep quality observed in this study.

Participants who engaged in active commuting also reported greater perceived well-being and lower levels of perceived stress than those in the Passive Commuting Group.

Previous studies have shown that active commuting may contribute to improvements in mental health and subjective well-being. Individuals who actively commute report greater life satisfaction and better psychological health than those using passive transportation (7).

In addition, active commuting may serve as a psychological transition between the home and work environments, contributing to stress reduction while increasing feelings of autonomy and control over the daily commute.

The findings of the present study reinforce the importance of active commuting as a health promotion strategy in urban settings. The literature indicates that urban interventions promoting walking and cycling can substantially increase population-level physical activity and reduce the burden of non-communicable diseases.

In this context, public policies encouraging the adoption of active commuting through the expansion of cycling infrastructure and the development of more walkable urban environments may represent an effective strategy for improving health indicators among the working population.

5. Conclusions

The findings of this cross-sectional study demonstrate that workers who regularly commuted by walking or cycling exhibited significantly better health indicators than those who used motorized transportation. Active commuters accumulated higher levels of physical activity, presented lower body mass index and body fat percentage, reported better sleep quality, and perceived greater energy, work disposition, and overall well-being, while reporting lower levels of perceived stress.

These findings support active commuting as an important public health strategy for improving workers' health while simultaneously promoting sustainable urban mobility.

From a practical perspective, these findings support initiatives aimed at encouraging active commuting through improvements in urban infrastructure, pedestrian and cycling safety, and workplace health promotion programs. Future longitudinal studies with larger and more diverse samples should investigate causal relationships and evaluate additional factors, such as commuting distance, environmental characteristics, and barriers to adopting active transportation.

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